

Notice of Allowability

Application No.

10/777,830

Examiner

Kevin M. Bernatz

Applicant(s)

GILL ET AL.

Art Unit

1773

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to interview of 8/31/06.
2. ☒ The allowed claim(s) is/are 1 and 3-23.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 - a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
 5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date 8/31/06 2006 0901
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____

Examiner's Amendment

1. An Examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.

- The title has been amended as follows: the word "Iridium" was replaced with the following phrase: "Greater Than About 15 Angstrom Thick".

2. An Examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.

3. Authorization for this examiner's amendment was given in a telephone interview with Mr. Dominick Kotab on August 31, 2006.

The application has been amended as follows:

- Claim 1, line 4: before "formed", the following phrase was inserted: "having a thickness of at least about 15 Å"; and
- Claim 2 was cancelled.

Reasons for Allowance

4. The present claims are deemed allowable over the references of record since the references of record fail to disclose or render obvious a magnetic head meeting the claimed AP coupling layer thickness limitation in combination with the magnetic moment limitations of the bias layer and free layer.

While Mack et al. disclose forming a Ru AP coupling layer above a free layer meeting applicants' claimed magnetic moment limitations (*i.e. "magnetic moments of the tab regions of the free layer being pinned antiparallel to the magnetic moments of the bias layers"*), Mack et al., alone or in view of Parkin, fail to teach or render obvious using a layer meeting applicants' claimed thickness limitation (*claim 11*) and material limitation (*claim 1*).

Specifically, the Examiner notes that Mack et al. desires to insure a high coupling strength between the free layer and the bias elements. The Examiner deems that this would render Ru at the first or second AP peak (*at ~ 8 Å, see Bloemen et al., Phys. Rev. B, 1994, pages 13-505, 13-506, 13-511, 13-512, and Figure 9*) or Ir at its first peak (*~4 Å via Parkin, Table 1*) as obvious variants, but Mack et al. would teach away from using thicker values for the various AP coupling materials since (1) such thicker layers would possess significantly smaller AP coupling values than either of the three embodiments above, and (2) such thicker layers would be counterproductive since Mack et al. etches away the layer (or oxidizes the layer) in the region between the exchange tabs. Hence, the Examiner deems that Mack et al. effectively teaches away from using a Ru layer at a thickness greater than the 2nd AP coupling peak (*~8 Å*) or Ir

or other AP coupling materials at thickness values greater than their 1st AP coupling peak.

5. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Examiner's Comments

6. In order to better clarify the record, the examiner wishes to point out that several references are related to the claimed invention, but fail to anticipate or render obvious the present claims. These references are:

- Li et al. (U.S. Patent No. 7,010,848 B2 and U.S. Patent App. No. 2003/0156361 A1), which disclose a structure comprising bias layers, AP coupling layers formed of Ru or Ir and a free layer meeting applicants' magnetic moment limitation, but only teach AP coupling layer thickness values of 2 – 9 Å (*Paragraph 0048*). The Examiner notes that going to thicker layers is deemed non-obvious for substantially the same reasoning as applied above;
- Hasegawa et al. (U.S. Patent No. 7,075,759 B2) teach a structure comprising bias layers, coupling layers and a free layer, wherein the coupling layer can comprise Ir of a thickness of 3 – 20 Å (*col. 16, line 48 bridging col. 18, line 67*). However, Hasegawa et al. is directed to an invention where the coupling

layer provides ferromagnetic coupling between the free layer and the bias layers (*i.e. the magnetic moments of the two layers are parallel, not antiparallel*);

- Hasegawa (U.S. Patent No. 7,079,362 B2) disclose a structure comprising bias layers, AP coupling layers formed of Ru or Ir and a free layer meeting applicants' magnetic moment limitation, as well as forming the layers at their first or second AP coupling peak. However, the thickness range cited for the layers are 3 – 10 Å and the Examiner deems there is insufficient specificity to "pick and choose" Ir at the second peak thickness (*col. 5, line 59 bridging col. 6, line 23*). Furthermore, the Examiner notes that going to thicker layers is deemed non-obvious for substantially the same reasoning as applied above;
- Hasegawa et al. (U.S. Patent No. 7,092,218 B2), disclose a structure comprising bias layers, AP coupling layers formed of Ru or Ir and a free layer meeting applicants' magnetic moment limitation, but only teach AP coupling layer thickness values of 11 Å or less (*col. 15, line 52 bridging col. 16, line 20*). The Examiner notes that going to thicker layers is deemed non-obvious for substantially the same reasoning as applied above;
- Shimazawa et al. (U.S. Patent No. 6,982,855 B2) disclose a structure comprising bias layers, coupling layers formed of Ru or Ir and a free layer wherein the coupling layer thickness ranges from 3 – 20 Å (*col. 2, lines 1 – 52 and col. 7, lines 17 - 24*). However, while Shimazawa et al. disclose controlling the portion of the *free layer* under the bias tabs to possess

magnetic moments antiparallel to the portion of the *free layer* not under the bias tabs (*col. 2, lines 40 – 52*), Shimazawa et al. fail to teach that the coupling layer is selected to provide antiparallel magnetic moments between the bias layer and the free layer. Furthermore, the Examiner notes that the only examples utilize a thin (5 Å) Ru layer, which may inherently be AP coupled, but the Examiner notes that going to thicker layers is deemed non-obvious for substantially the same reasoning as applied above;

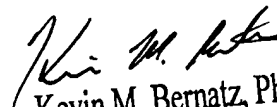
Conclusion

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin M. Bernatz whose telephone number is (571) 272-1505. The examiner can normally be reached on M-F, 9:00 AM - 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carol Chaney can be reached on (571) 272-1284. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

KMB
September 1, 2006


Kevin M. Bernatz, PhD
Primary Examiner